Grade 5 Standards and Learning Activities

SCIENTIFIC THINKING AND INQUIRY

5.1. Broad Concept: Scientific progress is made by asking relevant questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in this grade, students should develop their own questions and perform investigations.

Students:

1. Recognize and describe how results of similar scientific investigations may turn out differently because of inconsistencies in methods, materials, and observations, or because of limitations of the precision of the instruments used.

2. Evaluate the validity of claims based on the amount and quality of the evidence cited.

3. Keep a notebook to record observations and be able to distinguish inferences from actual observations.

4. Write instructions that others can follow to carry out an investigation.

5. Read and follow step-by-step instructions when learning new investigations.

6. Identify the controlled variable and at least one independent variable in a scientific investigation, when appropriate.

7. Explain that predictions can be based on what is known about the past, assuming that conditions are similar.

8. Realize and explain why predictions may be more accurate if they are based on large collections of similar events for statistical accuracy.

9. Determine area and volume of rectangular shapes from linear dimensions, using the expressions $A = l \times w$ and $V = l \times w \times h$.

10. Understand how plotting data on a number line helps in seeing where the data lie, including the outliers.

11. Explain the distortion inherent in using only a portion of the data collected to describe the whole. Understand that it is sometimes acceptable to discard data.

Examples

Students evaluate how heating water affects the rate at which salt and sugar dissolve (5.1.1).

Students discuss the kinds of medicine used in the last 150 years and the "evidence" for certain treatments. They research the recent medical development of antibiotics based on knowledge gained from technology and what researchers have learned from microorganisms (www.pbs.org/wgbh/aso/tryit/doctor) (5.1.2).

Students observe cells in class or on the Web site cellsalive.com/howbig.htm. They make scale drawings of the magnified cells and viruses and return to their notebooks to add information as the year progresses (5.1.3).

After the teacher demonstrates the reaction of a small amount of baking soda with vinegar, the class writes directions for the demonstration that include measurements and safety requirements (5.1.4).

Students make bubble solutions out of soap and water, and try to blow the largest bubbles. They identify conditions, such as blower size, amount of air used to blow the bubble, and water/soap ratio, as different causes of the changing effect: bubble size (5.1.6).

SCIENTIFIC THINKING AND INQUIRY (CONTINUED)	
	Students collect weather maps for two weeks. They use that information to predict weather in the coming week (5.1.7). *Students plot the highs and lows of local temperature on a number line over the course of two weeks (5.1.10).* *Students discuss the validity of a prediction of temperature based on two days of plotting highs and lows, versus two weeks of plotting the data (5.1.11).* *Students make a parachute out of string, a plastic bag, and a paper clip. They try to determine the average hang time using two trials and then five trials (5.1.11).*

SCIENCE AND TECHNOLOGY

5.2. Broad Concept: Although each of the human enterprises of science and technology has a character and history of its own, each is dependent on and reinforces the other. As a basis for understanding this concept,

Students:

1. Give examples of technology, such as telescopes, microscopes, and cameras, that enable scientists and others to observe things that are too small or too far away to be seen without them and to study the motion of objects that are moving very rapidly or are hardly moving.
2. Give examples of advances in technology that have positively and/or negatively affected society.
3. Give examples of materials not present in nature that have become available because of science and technology, such as cloth, metal alloys, plastic, ceramics, and concrete.

Examples	*Students make their own tools to expand their kinds of observations: a microscope (using magnifiers), a camera (using an oatmeal box to make a pinhole container), and a telescope (using a set of lenses) (5.2.1).* *Students evaluate the benefits and drawbacks of children using the Internet (5.2.2).* *Students visit the National Building Museum to check out various building materials (5.2.3).*

EARTH SCIENCE

5.3. Broad Concept: The solar system consists of planets and other bodies that orbit the sun in predictable paths. As a basis for understanding this concept,

Students:

1. Describe the Earth as part of a system called the *solar system,* which includes the sun (a star), planets, comets, asteroids, and many moons.
2. Recognize that the Earth is the third planet from the sun in our solar system.
3. Demonstrate how the Earth orbits the sun in a year's time, and Earth rotates on its axis about once every 24 hours.
4. Describe that, like all planets and stars, the Earth is approximately spherical in shape.

EARTH SCIENCE (CONTINUED)	
5. Explain that the alternation between day and night and the apparent movement of the sun, moon, and stars across the sky depend on the rotation of the Earth on its axis.	
6. Observe how telescopes are used both to magnify images of distant objects in the sky, including the moon and the planets, and to gather enough light from very dim objects to make them visible.	
7. Observe and describe that stars vary in size, but they are so far away that they look like points of light.	
8. Observe stars and identify ones that are unusually bright, and others that have unusual colors, such as red or blue.	
Examples	*Students make a sundial for daily records of sunshine. They also note the changing positions of shadows as the year moves ahead (5.3.3).* *Students hang models of stars and other celestial bodies from the ceiling. Each student draws a sky map from his or her perspective. They evaluate the differences in their maps (5.3.5).* *Students visit hubblesite.org to examine the workings of the telescope or the pictures it has been able to provide (5.3.6).*

5.4. Broad Concept: Water on Earth moves from the ocean to the land through the processes of evaporation and condensation. As a basis for understanding this concept,

Students:

1. Investigate and describe that when liquid water evaporates, it turns into a gas (vapor) mixed into the air, and can condense and reappear as a liquid when cooled or as a solid (ice) if cooled below the freezing point of water.	
2. Explain how water moves in air masses from one place to another in the form of clouds, fog, or as invisible water vapor, and falls to the Earth as rain, hail, sleet, or snow.	
3. Describe that clouds are made of tiny droplets of water or ice crystals.	
4. Explain that the air around us is matter and has weight (a force) and exerts pressure; explain that air pressure varies a little from place to place and from time to time.	
5. Describe that winds blow from areas of higher pressure to areas of lower pressure.	
6. Explain how global patterns, such as the jet stream and ocean currents, influence local weather and climate in ways that can be measured in terms of temperature, pressure, wind direction and speed, and amounts of precipitation.	
7. Explain that water on Earth cycles through different forms and in different locations (e.g., underground water and vapor in the atmosphere).	
8. Using maps and globes, recognize that the Earth's oceans are all connected as one body of water that covers about three-quarters of the Earth's surface.	
Examples	*Students investigate the process of evaporation by placing one wet paper towel in an open container and placing another wet paper towel in a closed container. Students observe water vapor in one of these containers (5.4.1).* *Students design a safe method to collect the vapor from heated water and direct it to another location (5.4.2 and 5.4.3).*

EARTH SCIENCE (CONTINUED)

Students listen to the sound of a Wiffle ball as it is thrown. They drop pieces of paper and observe the effect of air resistance (5.4.4).

Students attempt to move small pieces of paper by creating air pressure with either their waving hands or fans (5.4.5).

Students make a model of the jet stream by filling a jar halfway with warm water, sprinkling some pepper into the water to represent nutrients on the ocean floor, and placing a colored ice cube into the jar. Students draw and describe their observations (5.4.6).

Students access and analyze the weather report from the local newspaper and watch brief meteorological reports from The Weather Channel. Students discuss the relationship between precipitation, temperature, and location on the globe (5.4.6).

Students observe a melting ice cube on a plot of land outside in the sun (5.4.7).

Students design and build a terrarium to demonstrate the water cycle. They draw a detailed picture of the water cycle, including key concept words such as sun, evaporation, warm air, water vapor, clouds, *and* precipitation *(5.4.7).*

Students observe the movement of continents over time and how that affected the shape of the water on the planet (www.ucmp.berkeley.edu/geology/anim1.html) (5.4.8).

PHYSICAL SCIENCE

5.5. Broad Concept: Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept,

Students:

1. Recognize that all matter is made of small particles called *atoms*, which are too small to see with our eyes; describe how atoms may combine to form molecules or crystalline solids (compounds).

2. Recognize that there are more than 100 different kinds of atoms (each called an *element*), which are displayed on the periodic table of elements.

3. Explain that all matter is made up of an element, a compound, or mixtures of elements and compounds.

4. Investigate and describe that heating and cooling cause changes in the properties of substances. For example, liquid water can turn into steam by boiling, and liquid water can turn into ice by freezing.

5. Explain that many kinds of chemical changes occur faster at higher temperatures.

6. Explain that when a warm object and a cool one are placed in contact, heat flows from the warmer object to the cooler one until they are both at the same temperature. Know that heat transfer can also occur at a distance by radiation.

7. Investigate and describe how some materials conduct heat much better than others, and poor conductors (insulators) can be used to reduce heat loss or gain.

Examples *Students dissolve salt in warm water in a clear glass container and place a thread in the water. They allow the water to evaporate, and they observe the crystal formation of the salt (5.5.1).*

PHYSICAL SCIENCE (CONTINUED)

Students imitate one element. Students relate where they may be found and the uses for the elements (5.5.2).

Students explain to younger students the difference between temperature and heat.

Students demonstrate that an ice cube melts faster when exposed to heat (e.g., heater, on a sidewalk in the sun) than an ice cube left at room temperature.

Students heat an egg or toast at different temperatures and observe changes (5.5.5).

Students take the temperature of hot water and cool water in containers that are connected by a piece of cloth with the temperatures of two containers of water (hot and cool) that are not in contact (5.5.6).

Students record the beginning temperatures of three jars filled with warm water. They leave one jar aside, wrap one jar in newspaper, and place the other in a jar in a box with crumpled newspaper around it. After one hour, students observe which wrapping serves as the best insulator (5.5.7).

5.6. Broad Concept: Unbalanced forces cause changes in velocity. As a basis for understanding this concept,

Students:

1. Explain that objects can move with a very wide range of speeds, with some moving very slowly and some moving too quickly for people to see them.

2. Demonstrate that if the forces acting on an object are balanced so that the net force is zero, the object will remain at rest if it is initially at rest or will maintain a constant speed and direction if it is initially moving.

3. Investigate and describe that unbalanced forces cause changes in the speed and/or direction of motion of an object (acceleration).

4. Describe that, for an object moving in a straight line, acceleration, a, is the change in velocity, v, divided by the time, t, that change takes ($a = v \div t$).

5. Investigate and describe that the greater the net force, F, applied to a body, the greater its acceleration, a. Describe that the greater the mass, m, of an object, the smaller the acceleration produced by a given force.

6. Demonstrate and explain that things on or near Earth are pulled toward Earth's center by the gravitational force that Earth exerts on them.

Examples *Students set up a bowling game with different sizes and masses of balls (5.6.1).*

Using video clips of two football players pushing with force in opposite directions, students observe what happens and explain why. For example, if neither player moves, they are pushing each other with equal amounts of force (5.6.2).

Students investigate the forces at play when a cyclist pedals up a hill, a bulldozer knocks down a wall, or a ball is thrown and caught in gym class (5.6.3).

Students set up a long ramp with a very low incline. They make three to four timing stations along the ramp at equal distances. Students mark the time at each station as the ball rolls to the bottom (5.6.4).

PHYSICAL SCIENCE (CONTINUED)	
	Students play slow-motion basketball with little force (5.6.5). *Students drop balls or objects of different masses from the same height (5.6.6).* *Students explore the interaction of gravity between the planets by using the gravity simulation (www.arachnoid.com/gravitation/index.html) (5.6.6).*

LIFE SCIENCE

5.7. Broad Concept: All living things are composed of cells, from just one to many quadrillions, whose details usually are visible only through a microscope. As a basis for understanding this concept,

Students:

1. Observe and describe that some organisms consist of a single cell that needs an environment that can supply food, water, sometimes oxygen, and a way to dispose of waste. (Some single-celled organisms are anaerobes.)
2. Observe and explain that some organisms are made of a collection of similar cells that benefit from cooperating.
3. Explain that in complex organisms such as humans, cells can have a very wide variety of forms and perform very different roles (e.g., nerve cells, muscle cells, and fat cells).

Examples	*Students discuss the interaction between different parts of the human body. They examine skin and blood cells under a microscope to reinforce the concept that even those larger parts are made of cells (5.7.2).* *Students use gslc.genetics.utah.edu/units/stemcells/whatissc to examine stem cells and the kinds of cells that can develop for very different functions from stem cells (5.7.3).*

5.8. Broad Concept: Many characteristics of an organism are inherited from the parents, but others result from the influence of the environment. As a basis for understanding this concept,

Students:

1. Explain why there must be a reliable way to transfer information from one generation to the next in order for offspring to resemble their parents.
2. List some characteristics of plants and animals that are fully inherited (e.g., form of flower, shape of leaves) and others that are affected by the climate or environmental conditions (e.g., browning of leaves from too much sun, language spoken).

Examples	*Students tour gene formation, chromosomes, heredity, and traits at gslc.genetics.utah.edu/units/basics/tour (5.8.1).* *Students root a spider plant or ivy plant by cutting a branch off a mother plant and placing the branch in water until roots appear (5.8.2).* *Students research how newly born sea turtles find their way to the ocean and juxtapose that with how pets are trained to learn new tricks (5.8.2).*

LIFE SCIENCE (CONTINUED)

5.9. Broad Concept: Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept,

Students:

1. Explain that in any particular environment, some kinds of plants and animals survive well, some do not survive as well, and some cannot survive at all.
2. Identify organisms that are not native to the Washington, DC, area and how they undergo changes to increase their chance of survival in the area.
3. Explain how organisms can cause changes in their environment to ensure survival, and how these changes may affect the ecosystem (the living and nonliving components of the environment).
4. Explain that organisms fit enough to survive in a particular environment will typically produce offspring fit enough to survive and reproduce in that particular environment. Over time, these inherited characteristics are carried as the predominant forms (e.g., adaptations such as shape of beak, length of neck, shape of teeth).
5. Explain how changes in an organism's habitat are sometimes beneficial and sometimes harmful, and how changes in the environment (drought, cold) have caused some plants and animals to die, migrate, or become extinct.
6. Explain that many plants and animals can survive harsh environments because of seasonal behaviors (e.g., in winter, some trees shed leaves, some animals hibernate).
7. Recognize that some behaviors are instinctive (e.g., turtles burying their eggs, human infants crying when hungry) and others learned (e.g., a wolf's hunting skills, humans' ability to build fires for warmth).
8. Describe well-defined plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward in response to gravity.
9. Examine the information that fossils provide us about living things that inhabited the Earth in the distant past, and describe how they can be compared both with one another and with living organisms according to their similarities and differences.
10. Recognize and describe how artifacts and preserved remains provide some evidence of the physical characteristics and possible behaviors of human beings and their ancestors who lived long ago.

Examples

Students contrast the structures and features of animals and plants of the rain forest with those of animals and plants of the arctic (5.9.1).

Students identify one man-made attribute that slows the erosion process (e.g., hay bales at a construction site, silt fence protecting sand dunes) and one attribute that accelerates it (e.g., paving a parking lot, cutting trees) (5.9.3).

Students identify the changes in arctic regions (e.g., the melting of the glaciers) and how animals are being impacted by this change (5.9.5).

Students grow bean plants in clear containers under different conditions of light, heat, and water (5.9.5 and 5.9.8).

Students compare the structure, function, and adaptations of a cactus to a pine tree (5.9.6).

LIFE SCIENCE (CONTINUED)
Students analyze the fossil evidence for human evolution and discuss what possible information they think can be gained from such small pieces of evidence (www.pbs.org/wgbh/evolution/humans/riddle/index.html) (5.9.9). *Students develop a time capsule that represents the conditions, circumstances, and opportunities of their own time. They use the analogy of that discovery millions of years later to the information that might be gained from fossils already millions of years old (5.9.10).*